Alaska FACE /FAQ

Fatality Assessment & Control Evaluation

Deckhand killed when struck by collapsed boom

FACE 99-AK-020

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SUMMARY

On June 16, 1999, a 32-year-old male deckhand (the victim) was injured when a boom on a fishing vessel collapsed. The victim and a coworker were standing under the boom, pulling net through a power block to bring a load of salmon on board. A wire cable, used to raise and lower the boom, snapped. The boom collapsed and knocked both men down. The power block struck the victim. The vessel captain and a skiff tender, who was in the skiff at the time of the incident, helped free the men and check their injuries. The captain went into the wheelhouse to radio for help, leaving the skiff tender to monitor the injured men. While on the radio, the skiff tender called to the captain that the victim had stopped breathing. CPR was started. Minutes later, several people from a nearby hatchery and another fishing vessel arrived and assisted with CPR. Two United States Coast Guard helicopters were dispatched, arriving 30 to 40 minutes after the incident. The coworker was hoisted from the vessel and transported to a medical facility. The victim, still receiving CPR, was transferred to the beach and then airlifted to the medical facility. He was later transported to a larger medical center where he died from his injuries 11 days later.

Based on the findings of the investigation, to prevent similar occurrences, employers/vessel owners should:

- Ensure that rigging is inspected regularly for wear and wire rope is replaced as needed and as recommended by the manufacturer;

- Ensure that at least two blocks are used in the boom rigging arrangement to improve weight distribution;

- Ensure that the rigging arrangement avoids obstacles and uses appropriately sized sheaves.

In addition, vessel owners should

- Consider the use of backup safety systems to rigging arrangements.

INTRODUCTION

At approximately 6:15 P.M. on June 16, 1999, a 32-year-old male deckhand (the victim) was injured and subsequently died when the boom of a fishing vessel collapsed. On July 1, 1999, the Occupational Safety and Health Administration (OSHA), Alaska Regional Office, notified the Alaska Division of Public Health, Section of Epidemiology. An investigation involving an injury prevention specialist for the Alaska Department of Health and Social Services, Section of Epidemiology, ensued on July 26, 1999. The incident was reviewed with OSHA, National Institute for Occupational Safety and Health (NIOSH) – Alaska Field Station, and US Coast Guard (USCG) officials. OSHA, USCG, and medical examiner reports were requested.

The commercial fishing operation in this incident was privately owned and employed two full time seasonal deckhands and a skiff tender. The company had been in business for 12 years. The owner/operator (hereafter referred to as the captain) had 20 years commercial fishing experience of which 15 years involved purse seining. Many workers in the commercial fishing industry are seasonal with little or no training or experience. This was the victim's second season of employment with the captain; the victim had worked 2 months as a deckhand on the same vessel during the previous season. At the time of the incident, he had been on the job for 8 days during the 1999 fishing season. The victim and his coworker (also a deckhand) were responsible for dispatching and retracting fishing nets and the subsequent placement of the load of fish into the hold of the vessel.

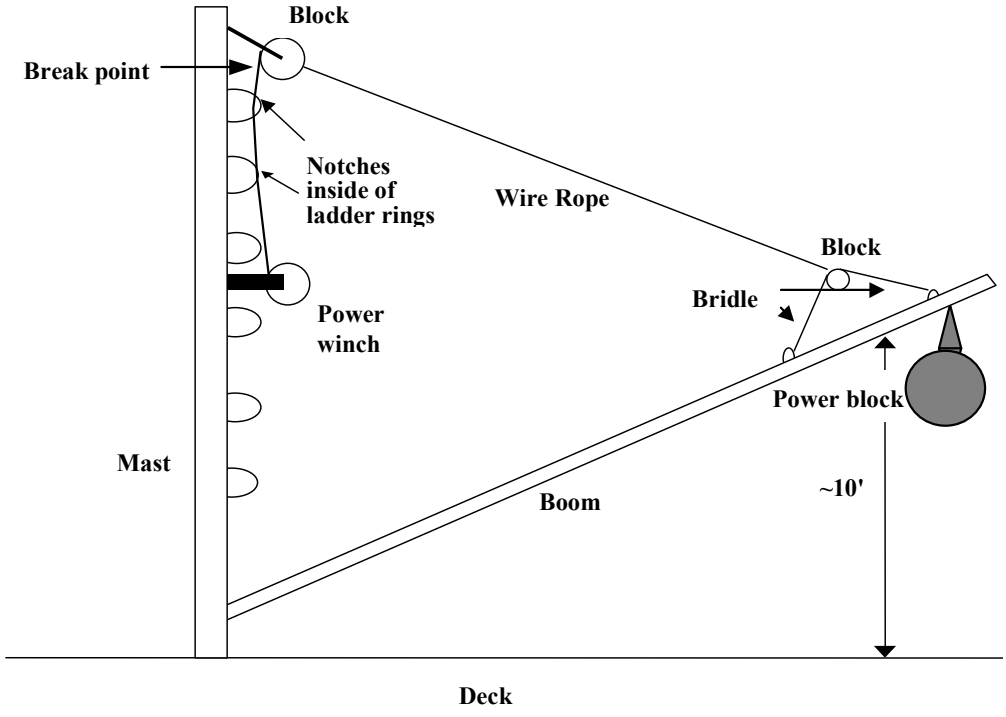
The captain did not have a written safety or training manual. All training was on-the-job. When necessary, activities would be stopped to discuss how to get fish on board.

INVESTIGATION

The vessel was participating in a salmon opening and was about 1 mile from shore. Weather at the time of the incident was calm.

The vessel was a 41-foot purse seiner with a 19-foot A-frame mast with a crow's nest. The boom was made of aluminum, weighed approximately 150 pounds, and was 25 feet long. The rigging assembly included a block at the top of the mast and a power winch located 7 feet below the block (Figure 1).

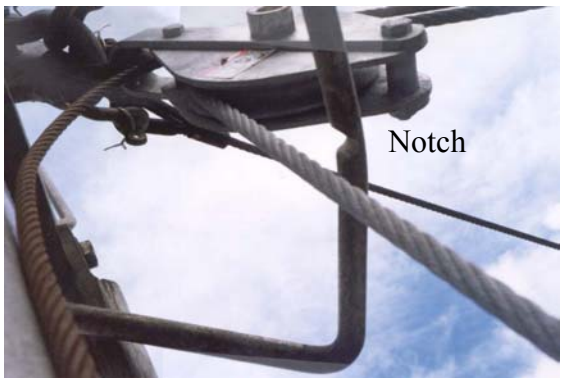
Figure 1. Diagram of rigging arrangement



ope was $^{3}/_{8}$-inch galvanized rigging rope consisting of six strands around a fiber core, which was suitable for marine applications. [Note: Most wire rope is made from preformed strands laid together around a central core of fiber or wire. Each strand is made from individual steel wires laid together.]

The rope was graded with a total lifting capacity of 2,700 pounds. During the investigation, about 5 feet of wire rope on the boom side of the break point appeared corroded (rusty). The last documented replacement date was in 1991. The manufacturer recommended replacement every 2 years. The wire rope ran inside the two highest step rungs on the mast. This arrangement caused the rope to rub against the step rungs and form notches on the inside surface. The deepest notch was on the top rung, immediately below the mast block, with a depth of approximately ½-inch (Figure 2).

Figure 2. Notch in step rung



As part of the rigging, a bridle was attached to the boom. The bridle consisted of approximately 6 feet of wire rope attached to the boom at two points, approximately 4½ feet apart. The bridle ran through a block that was attached to the end of the rigging rope (Figure 1). No modifications were made to the rigging by the owner/operator since buying the vessel in 1991.

To place the net in the water, one end of the net was attached to a skiff. The other end was fastened to the vessel. The skiff drew out the net and circled back around to the vessel (thus encircling the fish to be harvested) (Figure 3). The net floated in the water like a curtain, held vertical by a cork line (on top) and a lead line (on the bottom). A purse line was used to close the bottom of the net to create a bag or a purse.

A power block was used to pull the net back on board the vessel. The block was hydraulically powered with a V-shaped sheave lined with rubber (Figure 4a and 4b). The power block hung from the boom above the aft part of the vessel. As the power block brought the net on board, one or two deckhands stood under the boom to pull down on the net (to help it through the block) and

coil it on the deck. The net in the water was gradually made smaller until the fish were gathered on the side of the vessel. The fish (and the net) were either lifted on board by raising the boom or a fish pump was used to bring the fish on board.

Figure 3. Diagram of net placement in purse seine fishing

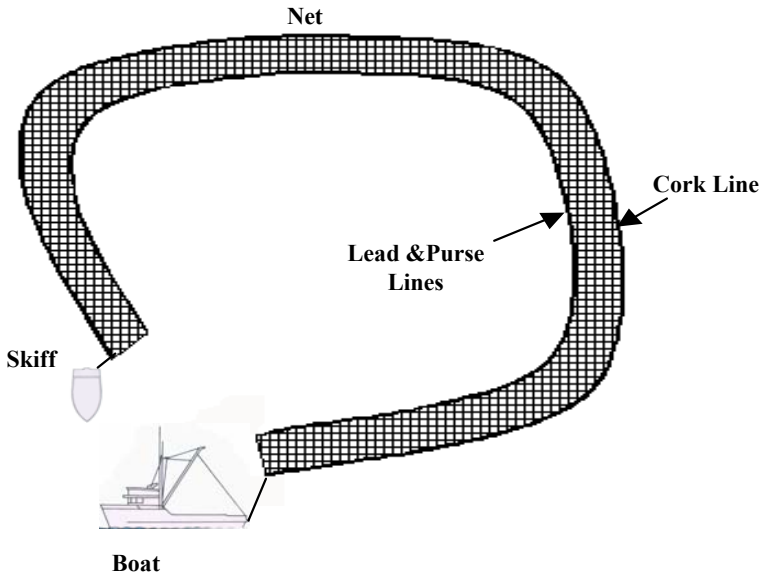


Figure 4a. Boom and power block

Figure 4b. Power block

The vessel had been salmon fishing for 2 days. Prior to the incident, the captain and the deckhands discussed how to get the net on board. These discussions were not unusual and were considered part of normal on-the-job training. On previous catches, only the victim handled the net. For this catch, both deckhands were to pull the net through the block. The captain estimated the weight of the catch at approximately 1,200 to 1,500 pounds, the largest haul of salmon so far

and within rigging capacity. After the discussion, the crew began to haul the net on board using the power block.

At the time of the incident, the boom was in an aft position. The captain was operating the controls to the power block (to bring in the net) and the power winch (to raise the boom). He had just begun to lift the boom when the wire rope broke. The boom was approximately 10 feet above the deck where the deckhands were standing when it collapsed. The victim was hit by the power block and knocked to the side of the vessel where he hung face down over the side. His coworker was knocked to the deck and was pinned under the boom and the power block. The captain immediately went to assist the deckhands. The skiff tender came on board to help. The captain flagged a passing skiff and requested the occupant to radio for help. The captain then went to the wheelhouse to radio the USCG for assistance. During the radio transmission, the skiff tender called the captain because the victim had stopped breathing and his pulse rate was dropping. The captain went back onto the deck and helped start CPR.

A group of people from a nearby hatchery responded to the captain's request for help and coordinated a CPR team. A second fishing vessel tied up alongside and helped with radio communication between the scene and the USCG. Two USCG helicopters arrived 30 to 40 minutes after the incident. The injured coworker was hoisted to the first helicopter. The USCG medivac coordinator requested that the victim be transported to the beach in order to continue CPR. The victim was moved to a skiff and transported to shore. He was then transferred to a litter and moved to the beach where the medivac coordinator was waiting. The victim was hoisted onto the second helicopter and transported to a nearby medical facility. He was later transported to another medical center where he died on June 27, 1999.

CAUSE OF DEATH

The report to the medical examiner listed the cause as impact [to] head, struck by fishing boom.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers/vessel owners should ensure that rigging is inspected regularly for wear and wire rope is replaced as needed and as recommended by the manufacturer.

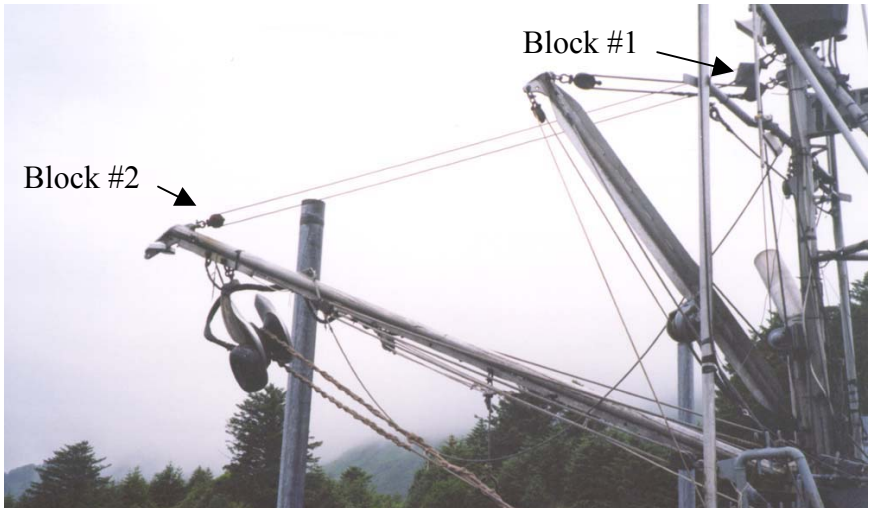
Discussion: The boom and rigging on a fishing vessel is an overhead hoist system. Special attention must be given to all parts of the system especially inspection and replacement of wire rope. Wire rope should be inspected and replaced as recommended by the manufacturer. Problems such as wear, metal fatigue, and corrosion reduce the life of wire rope. ANSI B30.16-1973 (Overhead Hoists) states "All running ropes in periodic use throughout the shift shall be visually inspected once each shift by the operator or an appointed person. A thorough inspection of all ropes shall be made at least once each month…. Any deterioration, resulting in appreciable loss of original strength, such as described below, shall be carefully noted and determination made as to whether further use of the rope would constitute a safety hazard." Indications of deterioration that merit questioning rope integrity and safety include:

1. Reduction of rope diameter of more than $^{1}/_{64}$-inch for diameter up to $^{5}/_{16}$-inch, or $^{1}/_{32}$-inch for diameter $^{3}/_{8}$-inch up to ½-inch
2. Broken outside wires along a rope (12 broken wires in a rope or four broken wires in one strand of a rope)
3. Worn outside wires and excessive wear points (outer wire wear exceeding $^{1}/_{3}$ of the original diameter) in areas passing over sheaves, through shackles, etc.
4. Corrosion or broken wires at end connections
5. Corrosion, cracking, bending, wear, or improperly applied end connections
6. Kinking, crushing, cutting, birdcaging, unstranding or any other damage resulting in distortion of the rope structure
7. Evidence of heat damage from any cause

Recommendation #2: Employers/vessel owners should ensure that at least two blocks are used in the boom rigging arrangement to improve weight distribution.

Discussion: The rigging consists of wire rope and pulleys, functioning as a block and tackle, that trades force for distance. In this incident, the combined weight of the boom, power block, wire rope, net, and fish was placed on the wire rope. Fishing vessels normally have a rigging arrangement with at least two blocks (Figure 5). Using a single block (or pulley) allows only a change in the direction of force needed to lift the boom. However, adding a second block (or pulley) suspends the weight by two lines rather than one, and half the force is needed to lift the same weight. This arrangement effectively reduces the stress placed on the wire rope and the winch although twice as much rope will be pulled to lift the boom the same distance.

Figure 5. Block arrangement and rigging



Recommendation #3: Employers/vessel owners should ensure that the rigging arrangement avoids obstacles and uses appropriately sized sheaves.

Discussion: In this incident, because the rope passed inside the metal step rungs located between the winch and the mast block, it rubbed against a ladder rung, producing weak spots. Wire rope winding over a winch drum and through sheaves will incur normal wear. However, the wrong sheave size, contact with surfaces and obstacles, or crushing from cross winding on a drum can markedly reduce the life of the rope. Rigging, as well as nearby surfaces, should be inspected for

deterioration or abrasion, and the rigging rearranged to eliminate factors that cause additional wear and reduced rope life.

Recommendation #4: Employers/vessel owners should consider the use of backup safety systems to rigging arrangements.

Discussion: Redundant arrangements or "backup safety systems" can often eliminate or reduce the severity of an injury. In the event that part of the set-up fails, a "backup system" like a safety cable could prevent workers from being struck by equipment.

Acknowledgement

The Alaska FACE Program thanks Jennifer Lincoln, Occupational Safety and Health Specialist, NIOSH – Alaska Field Station, for her contribution to this report.

Reference

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Fatality Assessment and Control Evaluation (FACE) Project

The Alaska Division of Public Health, Section of Epidemiology performs Fatality Assessment and Control Evaluation (FACE) investigations through a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research (DSR). The goal of these evaluations is to prevent fatal work injuries in the future by studying the working environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact.

Additional information regarding this report is available from:

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